

Somatic Cell Genealogies and Differentiation

17.2.09

Objective: To give a presentation of about 60 minutes at the end of the week covering the key aspects of integrative genomics, which is the combined analysis of data from multiple sources/levels.

The questions and contents below are meant as motivators and need not be followed. Since we give several lectures on IG, you should probably try to give a new angle in the presentation or focus on a few new and exciting publications.

The Big Questions:

How many cell generations are there within an individual?

How many mutations happen per cell generation?

Which kinds of phylogenetic hypotheses would be of interest to test?

How well can you infer the phylogeny for the cells of an organism?

What are the main application areas for cell genealogies?

Recommended literature is only meant to get you started. You might very well be able to find papers more suited for your purpose.

Bender et al. (2006) High levels of mitochondrial DNA deletions in substantia nigra neurons in aging and Parkinson disease. *Nat Genet.*;38(5):515-7

Frumkin et al (2005) "Genomic Variability within an Organism Exposes Its Cell Lineage Tree." *PLoS Comput Biol.* Oct;1(5):e50.

Dan Frumkin, Adam Wasserstrom, Shalev Itzkovitz, Tomer Stern, Alon Harmelin, Raya

Eilam, Gideon Rechavi, and Ehud Shapiro. Cell Lineage Analysis of a Mouse Tumor. *Cancer Res.* 68(14):5924-5931, 2008.

Khanna VK (2006) "Existing and emerging technologies for DNA finger printing, sequencing, bio- and analytical chips: A multidisciplinary approach unifying molecular biology, chemical and electrical engineering" *Biotech. Adv.* 25:85-98.

Kim JY, Tavaré S, Shibata D. "Human hair genealogies and stem cell latency." *BMC Biol.* 2006 Feb 3;4:2.

Kim JY, Tavaré S, Shibata D. "Counting human somatic cell replications: methylation mirrors endometrial stem cell divisions." *Proc Natl Acad Sci U S A.* 2005 Dec 6;102(49):17739-44.

Ro, S. and B.Rannala (2001) "Methylation patterns and mathematical models reveal dynamics cell turnover in the human colon" *Proc.Natl.Acad.Sci.*98.10519-21.

Shibata D, Tavaré S. "Counting divisions in a human somatic cell tree: how, what and why?" *Cell Cycle.* 2006 Mar;5(6):610-4.

Wasserstrom et al. (2008) "Reconstruction of Cell Lineage Trees in Mice" *PLOS Biology* 3.4:e1939-

Watase K, Venken KJ, Sun Y, Orr HT, Zoghbi HY. Regional differences of somatic CAG repeat instability do not account for selective neuronal vulnerability in a knock-in mouse model of SCA1. *Hum Mol Genet.* 2003 Nov 1;12(21):2789-95J.

E. Sulston, E. Schierenberg, J. G. White, and J. N. Thomson. The embryonic cell lineage of the nematode *Caenorhabditis elegans*. *Developmental Biology*, 100:64-119, 1983.

Eldad Tzahor, Eran Segal, and Ehud Shapiro. Reconstruction of cell lineage trees in mice. *PLoS ONE*, 3(4):e1939, 04 2008.

Darryl Shibata and Simon Tavaré. Stem Cell Chronicles: Auto-biographies Within Genomes. *Stem Cell Rev* (2007) 3:94-103.

Darryl Shibata. Stem cells as common ancestors in a colorectal cancer ancestral tree. *Current opinion in Gastroenterology.*24:59-63, 2008.

Bernards R, Weinberg RA. A progression puzzle. *Nature* 2002;418:823.

Nowell PC. clonal evolution of tumor cell populations. *Science* 1976;194:23-8.